

Applicants : David M. Mitteer et al.
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This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1 (previously presented): An electrically powered actuator, comprising:

a housing;

a coil disposed in the housing for generating a magnetic field when an electric current passes through the coil;

a center pole disposed within the coil, wherein the center pole is made of a ferromagnetic material;

a rod assembly movably disposed in the housing for movement between a rest position and an energized position, the rod assembly having a portion thereof disposed in the center pole, and including a magnet having a polarity causing the magnet to be repelled from the center pole when an electric current passes through the coil; and wherein:

the magnet is encapsulated by an elastomeric material that contacts a stop surface when in the rest position to reduce noise resulting from shifting of the rod assembly from the energized position to the rest position.

Claim 2 (previously presented): The electrically powered actuator of claim 1, wherein:

the rod assembly has an elongated body portion comprising a polymer material.

Claim 3 (previously presented): An electrically powered actuator, comprising:

a housing;

a coil disposed in the housing for generating a magnetic field when an electric current passes through the coil;

a center pole disposed within the coil, wherein the center pole is made of a ferromagnetic material;

a rod assembly movably disposed in the housing for movement between a rest position and an energized position, the rod assembly having an elongated body portion comprising a

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polymer material, and wherein a portion of the rod assembly is disposed in the center pole, and including a magnet having a polarity causing the magnet to be repelled from the center pole when an electric current passes through the coil;

the magnet is encapsulated by an elastomeric material that contacts a stop surface when in the rest position to reduce noise resulting from shifting of the rod assembly from the energized position to the rest position; and wherein:

the polymer material has a reflow temperature that is greater than the injection molding temperature of the elastomeric material.

Claim 4 (previously presented): The electrically powered actuator of claim 3, wherein:

the magnet is generally disk-shaped with generally parallel side surfaces and an opening extending between the side surfaces, and wherein the body portion extends along the side surfaces to retain the magnet.

Claim 5 (previously presented): The electrically powered actuator of claim 4, wherein:

the body portion includes a pair of outwardly extending flanges forming an annular groove therebetween having a base surface and parallel sidewall surfaces, the base surface and the sidewall surfaces contacting the magnet.

Claim 6 (previously presented): The electrically powered actuator of claim 2, wherein:

the magnet is positioned adjacent a first end of the rod assembly; and wherein:

the rod assembly includes a pawl member made of a non-ferromagnetic material at a second end of the rod assembly, the pawl member being made of material that is substantially harder than the polymer material of the body portion.

Claim 7 (previously presented): The electrically powered actuator of claim 6, wherein:

at least a portion of the pawl member extends outside of the housing when the rod assembly is in the rest position.

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Claim 8 (previously presented): An electrically powered actuator, comprising:

a housing;

a coil disposed in the housing for generating a magnetic field when an electric current passes through the coil;

a center pole disposed within the coil, wherein the center pole is made of a ferromagnetic material;

a rod assembly movably disposed in the housing for movement between a rest position and an energized position, the rod assembly having a portion thereof disposed in the center pole, and including a magnet positioned adjacent a first end of the rod assembly having a polarity causing the magnet to be repelled from the center pole when an electric current passes through the coil, the rod assembly having an elongated body portion comprising a polymer material;

wherein the magnet is encapsulated by an elastomeric material that contacts a stop surface when in the rest position to reduce noise resulting from shifting of the rod assembly from the energized position to the rest position; and wherein:

the rod assembly includes a pawl member made of a non-ferromagnetic material at a second end of the rod assembly, the pawl member being made of material that is substantially harder than the polymer material of the body portion;

at least a portion of the pawl member extends outside of the housing when the rod assembly is in the rest position; and

the pawl member is made of a stainless steel material, and the body portion is made of a fiber reinforced polymer material.

Claim 9 (previously presented): The electrically powered actuator of claim 8, wherein:

the rod assembly defines an axis and the pawl member includes a connector portion having a first portion extending in the direction of the axis, and a second portion extending transverse to the axis, the connector portion being encapsulated by the body portion.

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Claim 10 (currently amended): A rod assembly for an electrically powered actuator, comprising:

an elongated body having at least a portion thereof made of a non-ferromagnetic first material having a first melting temperature;
a magnet connected to the elongated body; and
a second material encapsulating at least a portion of the magnet, the second material having a second melting temperature that is less than the first melting temperature.

Claim 11 (original): The rod assembly of claim 10, wherein:

the second material has a hardness between about thirty-five to ninety Shore A durometer to form a damper.

Claim 12 (currently amended): ~~The rod assembly of claim 10, wherein:~~ A rod assembly for an electrically powered actuator, comprising:

an elongated body made of a first material having a first melting temperature;
a magnet connected to the elongated body;
a second material encapsulating at least a portion of the magnet, the second material having a second melting temperature that is less than the first melting temperature; and
wherein the first material comprises a polymer material.

Claim 13 (original): The rod assembly of claim 12, wherein:

the polymer material is reinforced with fibers.

Claim 14 (currently amended): ~~The rod assembly of claim 10, wherein:~~ A rod assembly for an electrically powered actuator, comprising:

an elongated body made of a first material having a first melting temperature;
a magnet connected to the elongated body;
a second material encapsulating at least a portion of the magnet, the second material having a second melting temperature that is less than the first melting temperature; and

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wherein the magnet is generally disk-shaped with generally parallel side surfaces and an opening extending between the side surfaces, and wherein the body portion extends along the side surfaces to retain the magnet.

Claim 15 (original): The rod assembly of claim 14, wherein:

the body portion includes a pair of outwardly extending flanges forming an annular groove therebetween having a base surface and parallel sidewall surfaces, the base surface and the sidewall surfaces contacting the magnet.

Claim 16 (original): The rod assembly of claim 15, wherein:

the magnet is positioned adjacent a first end of the rod assembly; and wherein:

the rod assembly includes a pawl member made of a non-ferromagnetic material at a second end of the rod assembly, the pawl member being made of material that is substantially harder than the polymer material of the body portion.

Claim 17 (previously presented): A method of making an electrically powered actuator, comprising:

providing a housing;

positioning a coil in the housing;

positioning a center pole of a ferromagnetic material within the coil;

providing a rod assembly having a body portion of a first material;

providing a magnet;

positioning the magnet on the body portion; and

encapsulating at least a portion of the magnet with an elastomeric second material to thereby form a damper that contacts a stop surface.

Claim 18 (original): The method of claim 17, wherein:

the magnet is generally disk-shaped with opposite side surfaces and an opening extending between the opposite side surfaces; and

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the body portion includes retaining portions that are molded around portions of the opposite side surfaces of the magnet.

Claim 19 (original): The method of claim 18, wherein:

a peripheral outer edge of the magnet is exposed after the body portion is molded around opposite side surfaces of the magnet, and the retaining portions comprise a pair of outwardly extending parallel flanges defining inner surfaces contacting the magnet and opposed outer surfaces; and including:

overmolding the second material around the peripheral outer edge of the magnet and around the opposed outer surfaces of the flanges.

Claim 20 (original): The method of claim 19, wherein:

the second material has a Shore A hardness of about thirty-five to ninety durometer.

Claim 21 (original): The method of claim 20, including:

providing a pawl member made of a non-ferromagnetic material and having a first end forming connecting structure; and

molding the body portion around the connecting structure.

Claim 22 (previously presented): The method of claim 17, wherein:

the body portion is molded of a polymer material having a first melting temperature; encapsulating at least a portion of the magnet includes overmolding the magnet with the second material; and

the second material has a molding temperature that is less than the reflow temperature of the polymer material.

Claim 23 (new): A rod assembly for an electrically powered actuator, comprising:

an elongated body made of a first material having a first melting temperature, the elongated body defining an exposed outer surface;

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a magnet connected to the elongated body; and
a second material encapsulating at least a portion of the magnet, the second material having a second melting temperature that is less than the first melting temperature, wherein the second material does not completely encapsulate the elongated body, such that a portion of the exposed outer surface is formed by the first material.

Claim 24 (new): The rod assembly of claim 23, wherein:
the first material is non-metallic.

Claim 25 (new): The rod assembly of claim 23, wherein:
the first material is a polymer.